

APPENDIX C
HAZOP Accident Scenario Ranking

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Accident	Scenario	# Node	Deviation	Consequence	Qualitative Consequence Ranking (Table 5.1-6)	Qualitative Frequency Ranking (Table 5.1-5)	Risk	Prevention/Mitigation
CH1	Fire/spontaneous ignition	07 TRUPACT-II internal condition	Fire in TRUPACT-II	Minor radioactive materials released	3	3	9	<u>Prevention:</u> Type A container, waste container integrity, QA, WHB construction, drum history, TRUPACT-II integrity, vented drums, WAC criteria. <u>Mitigation:</u> Reinstall ICV lid, WHB HEPA filtration and fire suppression systems, emergency response plan and teams.
CH2	Crane failure/breach	08 Transfer of payload from TRUDOCK to facility pallet	Failure of lifting equipment	Negligible radioactive materials released	2	3	6	<u>Prevention:</u> Type A container, crane fail safe design, QA, operator training and qualification, PM program, procedures, stretch wrapping on waste drums, WAC criteria, hoisting and rigging practices, operator with spotter, crane preoperational checks, waste container integrity. <u>Mitigation:</u> WHB HEPA filtration, emergency response plan and teams.
CH2	Crane failure/breach	08 Transfer of payload from TRUDOCK to facility pallet	Failure to secure load	Negligible radioactive materials released	2	3	6	<u>Prevention:</u> Type A container, fail safe design, QA, operator training and qualification, preoperational checks on equipment, PM program, procedures, stretch wrapping on waste drums, WAC criteria, hoisting and rigging practices, operator with spotter, waste container integrity. <u>Mitigation:</u> WHB HEPA filtration, emergency response plan and teams.
CH3	Forklift mishap/puncture	09 Transfer facility pallet to conveyance car	Forklift improper engagement of load	Negligible radioactive materials released	2	3	6	<u>Prevention:</u> Forklift design, QA, adequate lighting, operator training and qualification, preoperational checks on forklift, PM program, procedures, operator with spotter, WAC criteria, Type A container, waste container integrity. <u>Mitigation:</u> WHB HEPA filtration, emergency response plan and teams.

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CH4	Forklift mishap/breach	09 Transfer facility pallet to conveyance car	Moving accident	Negligible radioactive materials released	2	3	6	<u>Prevention:</u> Type A container, operator training and qualification, PM program, stretch wrapping on drums, operator with spotter, tie-down strapping, WAC criteria, procedures, preoperational checks on forklift, QA, waste container integrity. <u>Mitigation:</u> WHB HEPA filtration, emergency response plan and teams.
CH4	Forklift mishap/breach	09 Transfer facility pallet to conveyance car	Mislocation on the conveyance car	Negligible radioactive materials released	2	3	6	<u>Prevention:</u> Type A container, QA, operator training and qualification, restricted access, stretch wrapping on drums, operator with spotter, WAC criteria, procedures, tie-down strapping, waste container integrity, PM program, preoperational checks on forklift. <u>Mitigation:</u> Airlock doors interlocked, WHB HEPA filtration, emergency response plan and teams.
CH4	Car/breach	10 Transfer conveyance car load onto the waste cage	Moving accident	Negligible radioactive materials released	2	3	6	<u>Prevention:</u> Type A container, QA, operator training and qualification, procedures, stretch wrapping on drums, operator with spotter, tie-down strapping, WAC criteria, waste container integrity, PM program, pre-op checks, shaft tender at waste hoist shaft collar, pivot rails engage waste hoist conveyance rails to enable transferring the car. Front wheels of conveyance car dropping off the track will high center the car and stop movement. <u>Mitigation:</u> WHB HEPA filtration, emergency response plan and teams.

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CH5	Hoist failure/breach	11 Waste hoist	Waste hoist power loss and overtravel	Minor radioactive materials released	3	1	3	<u>Prevention:</u> WAC criteria, hoist preoperational checks and brake testing, cable NDT, acoustic testing for failed parts, redundant brakes and controls, control system has elevation check mechanisms, four independent valve failures required to fail brakes, brakes checked with full power, PM program, MSHA inspections, qualified and trained hoisting personnel, six hoist ropes each capable of holding load, periodic inspections including annual vendor inspection, visual inspection of structural steel assemblies, QA. <u>Mitigation:</u> Waste hoist conveyance is counterweighted which tends to reduce the impact speed if the brakes fail, the overtravel arrestor system at the top of the hoist tower has retarding timbers to absorb energy upon impact should the brakes fail, mechanical engagement of conveyance to the overtravel arrestor system in the hoist tower to prevent the conveyance from falling down the waste hoist shaft, underground ventilation HEPA filtration, emergency response plan and teams.
CH6	Seismic	15 Natural events	Seismic event	No radioactive materials released	2	1	2	<u>Prevention:</u> DBE qualified WHB and waste handling cranes, TRUPACT-II integrity, Type A containers, waste container integrity, QA. <u>Mitigation:</u> Emergency response plan and teams.
CH7	Fire/ Spontaneous ignition	27 Drum fire	Drum fire	Minor radioactive materials released	3	3	9	<u>Prevention:</u> Type A container, waste container integrity, drum history, vented waste containers, WAC criteria. <u>Mitigation:</u> Underground ventilation HEPA filtration, emergency response plan and teams.
CH8	Crash/fire/ breach	16 External events	Aircraft crashes into WHB	Minor radioactive materials released	3	1	3	<u>Prevention:</u> Flight patterns, remote location. <u>Mitigation:</u> WHB fire suppression system, emergency response plan and teams.

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CH9	Forklift mishap/breach	23 Life of facility	Floor distortion	Negligible radioactive materials released	2	3	6	<u>Prevention:</u> Drift inspections, floor surveys, MSHA inspections, forklift design, WAC criteria, stretchwrap on drums, waste secured to facility pallet with tie downs, Type A containers, procedures, personnel qualification and training. <u>Mitigation:</u> Ventilation flow, emergency response plan and teams, underground ventilation HEPA filtration.
CH10	Tornado	15 Natural events	Tornado	Negligible radioactive materials released	2	2	4	<u>Prevention:</u> Weather conditions monitored in CMR, WHB designed to withstand the DBT, waste handling cranes and waste hoist hold load in the event of loss of power during DBT, waste container integrity, procedural guidance for personnel protection, TRUPACT-II integrity, WAC criteria, Type A containers. <u>Mitigation:</u> Emergency response plan and teams.
CH11	Roof fall/breach	22 Storage room	Roof collapse during disposal	Negligible radioactive materials released	2	3	6	<u>Prevention:</u> Ground control inspections and assessments, roof bolting or removal of unstable ground, geotechnical monitoring to predict and verify closure rate, MSHA inspections, pre-employment checks, Type A containers, WAC criteria, procedures, training. <u>Mitigation:</u> Emergency response plan and teams, underground ventilation HEPA filtration.
CH11	Roof fall	23 Life of facility	Roof collapse in facility area during life of facility	Negligible radioactive materials released	2	2	4	<u>Prevention:</u> Ground control inspections and assessments, roof bolting or removal of unstable ground, geotechnical monitoring to predict and verify closure rate, MSHA inspections, pre-employment checks, Type A containers, WAC criteria, procedures, training. <u>Mitigation:</u> Underground ventilation HEPA filtration, emergency response plan and teams.

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CH12	Underground Diesel Fuel Fire	20 Disposal room waste handling operations	Diesel fire in unloading area	Minor radioactive materials released	2	1	2	<u>Prevention:</u> Limited quantity of diesel fuel, preoperational checks, floor surveys, MSHA inspections, forklift design, Type A containers, procedures. <u>Mitigation:</u> Fire suppression systems on transporter and forklift, operator training for fire scenarios, ventilation flow, emergency response plan and teams, underground ventilation HEPA filtration.

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